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The Sepioidea (Cephalopoda, Mollusca) fauna of the Aegean Sea: comparison with the neighbouring seas and notes on their diet composition

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Intensive samplings carried out in the Aegean Sea revealed the presence of 3 sepiid and 10 sepiolid species. A checklist of the Mediterranean Sepioidea is presented, as well as their distribution in the Mediterranean territorial areas and the Black Sea. The faunal comparison of the Mediterranean areas showed that the number of species decreases from the west to the east, while in the Black Sea, no sepioid species exist. In terms of zoogeographical categories, the Atlanto-Mediterranean species dominate in all Mediterranean areas followed by the endemic species. *Sepia pharaonis* Ehrenberg, 1831 is a Lessepsian migrant while only one species, *Stoloteuthis leucoptera* (Verrill, 1878), has a cosmopolitan distribution. The diet of the 13 sepioid species is mainly based on Crustacea and Pisces.

Key words: Sepiidae, Sepiolidae, Aegean Sea, distribution, diet composition.

INTRODUCTION

Concerning the Sepioidea fauna of the Aegean Sea, a limited number of focused papers exist (D'Onghia *et al.*, 1993, 1994; Lefkaditou & Kaspiris, 1998, 1999, 2005; Salman & Önsoy, 2004) while some others deal with the Aegean cephalopod fauna in general (Paspaleff, 1943; Digby, 1949; Rees, 1955; Adam, 1966; Katagan *et al.,* 1993; D'Onghia *et al.*, 1991, 1995; Salman *et al.*, 1997, 2002; Machias *et al.*, 2001; Lefkaditou *et al.*, 2003; Lefkaditou, 2007). Some scattered information has also been given in a few papers of wider subject (e.g. Forbes, 1844; Athanassopoulos, 1917; Belloc, 1948; Geldiay & Kocataş, 1972; Kallianiotis *et al.*, 2000; Koutsoubas *et al.*, 2000). Based on the above information, the sepiid and sepiolid fauna of the Aegean Sea consists of 15 species.

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With respect to the diet composition of the sepioids, there is some information (e.g. Mangold, 1983; Castro & Guerra, 1990; Blanc *et al.*, 1998; Alves *et al.*, 2006) on certain species, living mainly in the western Mediterranean Sea or the Atlantic Ocean.

The aim of this paper is to provide information: i) on the sepioid fauna of the Aegean Sea and to compare it with the corresponding ones of the neighbouring seas and (ii) on the diet composition of the sepiid and sepiolid species collected in the Aegean Sea.

MATERIALS AND METHODS

Samplings were carried out at 52 stations in the Aegean Sea (Fig. 1). The samples were obtained using fishing nets, bottom trawls, various types of traps and by free or SCUBA diving at depths of 0-1000 m. Mantle length and sex were determined for each specimen. The species identifications were mainly based

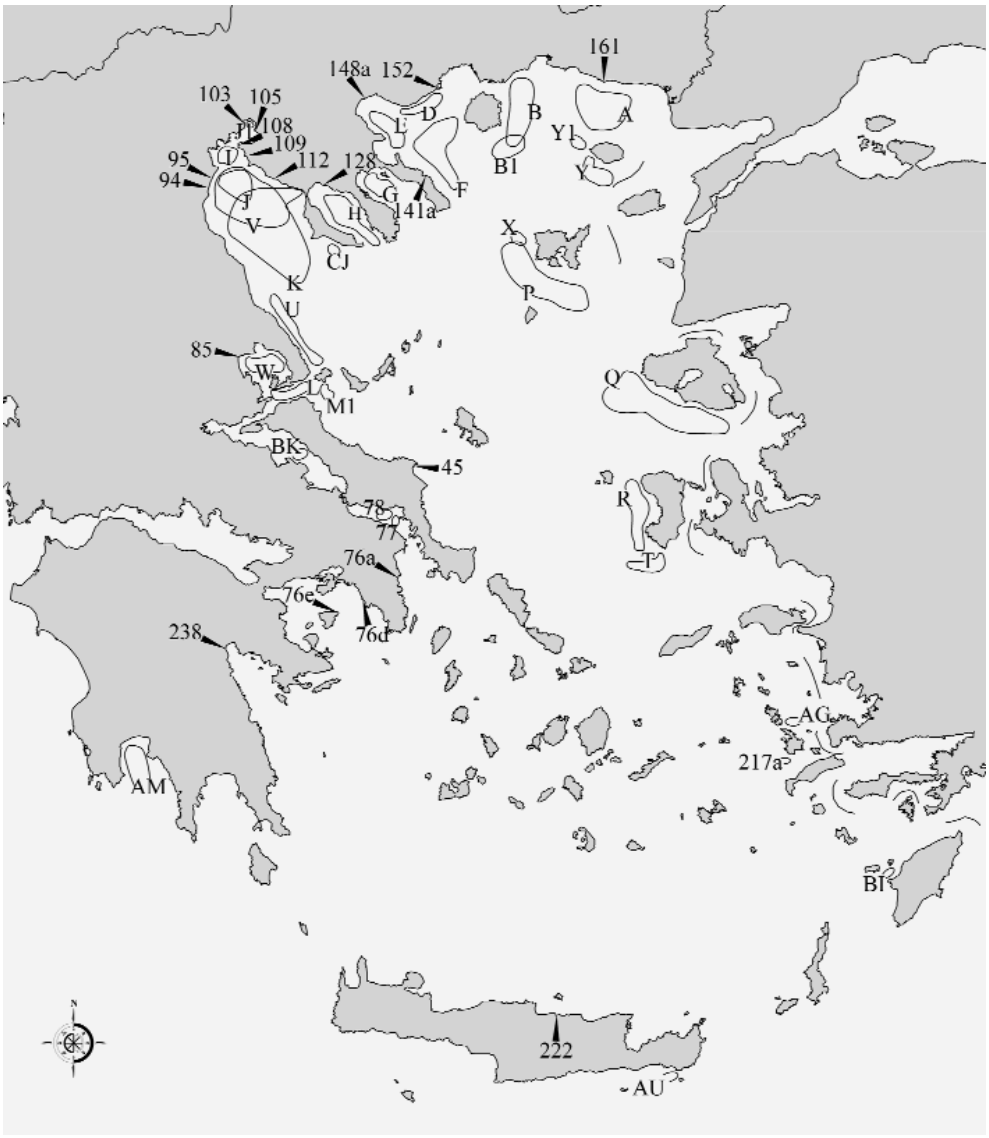

FIG. 1. Map of the Aegean Sea, indicating the sampling stations.

on the keys given by Bello (1995), Guerra (1992) and other recent relevant publications.

The diet composition of 211 individuals (92 belonging to Sepiidae and 119 to Sepiolidae) were examined. The stomach contents of all examined individuals were washed through a 125 μm sieve. All prey items were identified to the lowest possible taxonomic level, and counted. For the analysis of the collected data, the methods described by Hyslop (1980), Williams (1981) and Kelleher *et al.* (2000) were used and the following indices were calculated:

Frequency of occurrence (F): $F = n\ 100 / N_s$

Percentage of prey (N): $N = n'\ 100 / N_p$

where n = the number of stomachs containing a certain prey; N_s = the total number of stomachs examined; n′ = the total number of individuals of a certain prey; N_p = the total number of prey items. According to N values, prey categories were distinguished as preferential ($N > 50\%$), secondary ($10\% < N < 50\%$) and accidental ($N < 10\%$). The above indices were not estimated for the sepioid species having less than ten individuals.

All examined specimens have been deposited in the Museum of the Department of Zoology, Aristotle University of Thessaloniki (MDZAUT).

RESULTS

The following 3 sepiid and 10 sepiolid species were found in the Aegean Sea during the present study and they are presented below, along with information on their distribution and diet composition. The taxonomic classification followed is that given by Jereb & Roper (2005).

Order SEPIOIDEA Naef, 1916

Family SEPIIDAE Keferstein, 1866

Sepia elegans de Blainville, 1827

Material examined: 29 ♂♂, 37 ♀♀, 9 juveniles (juv.): stations (stas.) 78, 103, 108, 217a, 222, D, E, F, G, H, I, J, K, L, P, Q, W, X and Y; depth: 20-500 m; ML_{max} ♂ = 56 mm, ML_{max} ♀ = 74 mm.

Distribution: A species known from various areas in the Aegean Sea (e.g., Paspaleff, 1943; Lefkaditou *et al.*, 2003).

A common Atlanto-Mediterranean species (Table 1) known from all over the Mediterranean Sea and the Atlantic (e.g. Jatta, 1896; Bellini, 1929; Rees, 1955; Adam, 1966; Demetropoulos, 1969; Bello, 1990; Khromov *et al.*, 1998).

Diet composition: Prey categories found in the examined stomachs, their frequency of occurrence index (F) and prey percentage index (N) values are given in Table 2. The stomach contents of 41 (15 ♂♂, 26 ♀♀) individuals were examined. The most abundant prey category was Crustacea followed by Pisces (Table 2). Among Crustacea, Decapoda Natantia was the most abundant prey category followed by Mysidacea and Amphipoda (Table 2).

Sepia officinalis Linnaeus, 1758

Material examined: 18 ♂♂, 16 ♀♀: stas. 45, 76a, 76d, 76e, 77, 85, 94, 95, 105, 112, 128, 152, 161, 222, 238, F, H, K, V and I; depth: 1-250 m; ML_{max} ♂ = 110 mm, ML_{max} ♀ = 140 mm.

Distribution: This is a very common species, known from various areas in the Aegean Sea (e.g. Forbes, 1844; Lefkaditou *et al.*, 2003).

An Atlanto-Mediterranean species (Table 1), known from all over the Mediterranean Sea and the Atlantic (e.g. Jatta, 1896; Bellini, 1929; Rees, 1955; Guerra, 1982a; Bello, 1983-84, 1990).

Diet composition: The examination of 24 (14 ♂♂, 10 ♀♀) individuals showed that the most abundant prey category was Crustacea, followed by Pisces (Table 2). Among Crustacea, Decapoda Natantia was the most abundant prey category, followed by Mysidacea (Table 2).

Sepia orbignyana de Férrusac, 1826

Material examined: 30 ♂♂, 27 ♀♀: stas. 78, 108, 109, 148a, 222, AG, AM, AU, BI, G, K, M1, R, U, V and W; depths: 15-500 m; ML_{max} ♂ = 67 mm, ML_{max} ♀ = 125 mm.

Distribution: A species reported from various areas in the Aegean Sea (e.g. Adam, 1966; Lefkaditou *et al.*, 2003).

An Atlanto-Mediterranean species (Table 1) known from all over the Mediterranean Sea and the Atlantic (e.g. Jatta, 1896; Ruby & Knudsen, 1972; Bello, 1983-84, 1990; Katagan *et al.*, 1993; Khromov *et al.*, 1998).

Diet composition: The examination of 27 individuals (14 ♂♂, 13 ♀♀) showed that the most abundant prey category was Crustacea followed by Pisces (Table 2). Among Crustacea, Decapoda Natantia was the most abundant prey category, followed by Mysidacea and Amphipoda (Table 2).

Family SEPIOLIDAE Leach, 1817

Heteroteuthis dispar (Rüppell, 1845)

Material examined: 1 ♀: sta. Y1; depth: 660-667 m; ML ♀ = 25 mm.

Distribution: A species known from various areas in the Aegean Sea (e.g. Degner, 1926; Salman *et al.*, 2003).

An Atlanto-Mediterranean species known from all over the Mediterranean Sea and the Atlantic regions (e.g. Jatta, 1896; Adam, 1966; Berdar & Cavallaro, 1975; Bello, 1990; Guerra, 1992).

Diet composition: The stomach contents of the examined individual revealed the following two prey categories: Crustacea (Decapoda Natantia and Mysidacea) and Pisces.

Neorossia caroli (Joubin, 1902)

Material examined: 3 ♂♂, 3 ♀♀: stas. K, T and X; depth: 30-300 m; ML_{max} ♂ = 38 mm, ML_{max} ♀ = 51 mm.

Distribution: A species known from various areas of the Aegean Sea (e.g. D'Onghia *et al.*, 1991, Lefkaditou & Kaspiris, 2005).

An Atlanto-Mediterranean species (Table 1) known from the western (e.g. Morales, 1962; Villanueva, 1995) and the central Mediterranean Sea (e.g. D'Onghia *et al.*, 1991; Jereb & Di Stefano, 1995), the

TABLE 1. Check list of the Mediterranean Sepiidae and Sepiolidae and their distribution in certain geographical areas of the Mediterranean and the Black Sea, with reference to their presence in the Atlantic and Indo-Pacific Oceans

Mediterranean species	WM	CM	AD	AS	LB	BS	AO	IP	ZC	VD (m)
Sepiidae Keferstein, 1866										
Sepia elegans de Blainville, 1827	+	+	+	+	+		+		AM	30-500 (20-500)
Sepia officinalis Linnaeus, 1758	+	+	+	+	+		+		AM	2-200 (1-250)
Sepia orbignyana de Férussac, 1826	+	+	+	+	+		+		AM	15- 570 (15-500)
Sepia pharaonis Ehrenberg, 1831					+			+	LM (IP)	2-130
Sepiolidae Leach, 1817										
Heteroteuthis dispar (Rüppell, 1845)	+	+	+	+	+		+		AM	100-1588 (660-667)
Neorossia caroli (Joubin, 1902)	+	+	+	+			+		AM	40-1744 (30-300)
Rondeletiola minor (Naef, 1912)	+	+	+	+	+		+		AM	76- 496 (80-371)
Rossia macrosoma (Delle Chiaje, 1830)	+	+	+	+	+		+		AM	32-899 (25-1000)
Sepietta neglecta Naef, 1916	+	+	+	+	+		+		AM	24-475 (20-500)
Sepietta obscura Naef, 1916	+	+	+	+	+				E	27-376 (25-280)
Sepietta oweniana (d' Orbigny, 1840)	+	+	+	+	+		+		AM	8-1000 (25-1000)
Sepiola affinis Naef, 1912	+	+	+	+					E	20-178 (30-180)
Sepiola atlantica d' Orbigny, 1840	+	+					+		AM	5-150
Sepiola aurantiaca Jatta, 1896	+						+		AM	200-400
Sepiola intermedia Naef, 1912	+	+	+	+					E	8-200 (30-160)
Sepiola ligulata Naef, 1912	+	+	+	+					E	44-380
Sepiola robusta Naef, 1912	+	+	+	+	+				E	26-498 (0-280)
Sepiola rondeleti Leach, 1817	+	+	+	+	+		+		AM	2-450
Sepiola steenstrupiana Levy, 1912	+		+		+			+	E (1)	47
Stoloteuthis leucoptera (Verrill, 1878)	+						+	+	C	160-700
Total number of species: 20	19	16	16	15	13	0				

WM = Western Mediterranean, CM = Central Mediterranean, AD = Adriatic Sea, AS = Aegean Sea (including the Sea of Marmara), LB = Levantine Basin, BS = Black Sea, AO = Atlantic Ocean, IP = Indo-Pacific Ocean (Red Sea). Zoogeographical characterization (ZC): AM, Atlanto-Mediterranean species; C, Cosmopolitan species; LM, Lessepsian migrants; E, Possibly endemic species. VD = Vertical (bathymetric) distribution according to the literature; in parenthesis, the authors data.

(1) Rocha *et al.* (1998) recorded this species from Somalian waters (Indian Ocean)

Adriatic Sea (e.g. Bello, 1990) and the Atlantic Ocean (e.g. Guerra, 1982a).

Diet composition: The stomach contents of 6 (3 ♂♂, 3 ♀♀) individuals were examined. Crustacea (5 prey items) and Pisces (3 prey items) were the major prey categories. Among Crustacea, Decapoda Natantia (5 prey items) were the most abundant prey, followed by Mysidacea (3 prey items), Decapoda Brachyura (2 prey items) and Amphipoda (1 prey item).

Rondeletiola minor (Naef, 1912)

Material examined: 32 ♂♂, 10 ♀♀: stas. B1, CJ, H, K, M1 and Q; depth: 80-371 m; ML_{max} ♂ = 25 mm, ML_{max} ♀ = 30 mm.

Distribution: A species known from various areas of the Aegean Sea (e.g. Katagan & Kocataş, 1990; Lefkaditou & Kaspiris, 2005).

An Atlanto-Mediterranean species (Table 1) known from all the Mediterranean territorial areas and the Atlantic Ocean (e.g., Morales, 1962; Adam, 1966; Knudsen, 1981; Guerra, 1982a, b; Bello, 1990).

Diet composition: The examination of the stomach contents of 14 (7 ♂♂, 7 ♀♀) individuals showed that the most abundant prey category was Crustacea, followed by Pisces (Table 2).

Rossia macrosoma (Delle Chiaje, 1830)

Material examined: 10 ♂♂, 14 ♀♀: stas. F, G, H, K, T, V and X; depth: 25-1000 m; ML_{max} ♂ = 55 mm, ML_{max} ♀ = 74 mm.

Distribution: A species known from various areas of the Aegean Sea (e.g. D'Onghia *et al*., 1994; Lefkaditou & Kaspiris, 2005).

An Atlanto-Mediterranean species (Table 1) known from all the Mediterranean territorial areas and the Atlantic Ocean (e.g. Vérany, 1851; Jatta, 1896; Bellini, 1929; Guerra, 1982a; Bello, 1990; Jereb & Ragonese, 1994; Salman *et al*., 2002).

Diet composition: The examination of the stomach contents of 18 (5 ♂♂, 13 ♀♀) individuals showed that Crustacea was the most abundant prey category followed by Pisces (Table 2). Among Crustacea, Decapoda Natantia was the most abundant prey category, followed by Mysidacea (Table 2).

Sepietta neglecta Naef, 1916

Material examined: 25 ♂♂, 23 ♀♀: stas. 78, 95, 141a, CJ, E, F, I, M1, X and W; depth: 20-500 m; ML_{max} ♂ = 28 mm, ML_{max} ♀ = 35 mm.

Distribution: A species reported from various areas of the Aegean Sea (e.g. Digby, 1949; Lefkaditou & Kaspiris, 2005).

An Atlanto-Mediterranean species (Table 1) known from all over the Mediterranean Sea and the Atlantic Ocean (e.g. Bellini, 1929; Ruby & Knudsen, 1972; Guerra, 1982a; Bello, 1990; Jereb & Di Stefano, 1995).

Diet composition: The stomach contents of 14 (11 ♂♂, 3 ♀♀) individuals were examined. The most abundant prey category was Crustacea, followed by Pisces Among Crustacea, Mysidacea was the most abundant prey category, followed by Decapoda Natantia, Amphipoda and Unidentified Crustacea (Table 2).

Sepietta obscura Naef, 1916

Material examined: 4 ♂♂, 2 ♀♀: stas. B, F, M1 and W; depth: 25-280 m; ML_{max} ♂ = 24 mm, ML_{max} ♀ = 27 mm.

Distribution: A species known from various areas of the Aegean Sea (e.g. Paspaleff, 1943; Salman *et al.*, 2002).

An endemic Mediterranean species (Table 1) known from all the Mediterranean areas (e.g. Bellini, 1929; Knudsen, 1981; Bello, 1990; Jereb & Ragonese, 1994). Recently, two specimens of this species were found off the Portugal coast (Pereira, 1996).

Diet composition: The stomach content analysis of the 6 (4 ♂♂, 2 ♀♀) individuals showed two major prey categories: Crustacea (5 prey items) and Pisces (1 prey items). Crustacea were represented by Decapoda Natantia (4 prey items), Mysidacea (1 prey item) and Amphipoda (1 prey item).

Remarks: Nesis (1987) considered *Sepietta obscura* as a junior name for *S. petersi* (Steenstrup, 1887). According to Reid & Jereb (2005), Naef (1916) in his original description of *S. obscura*, did not cite Steenstrup's work and it is possible that he may have overlooked the description of *S. petersi* when determining the status of his alleged new *Sepietta* species. However, *S. obscura* is retained here as the valid name of the species.

Sepietta oweniana (d'Orbigny, 1840)

Material examined: 63 ♂♂, 54 ♀♀: stas. B, B1, CJ, E, F, G, H, J, K, M1, R, T and V; depth: 25-1000 m; ML_{max} ♂ = 25 mm, ML_{max} ♀ = 34 mm.

TABLE 2. Prey categories found in the stomachs of the examined species

Species / Prey category	*Sepia elegans* Ns = 41		*Sepia officinalis* Ns = 24		*Sepia orbignyana* Ns = 27		*Rondeletiola minor* Ns = 14		*Rossia macrosoma* Ns = 18		*Sepietta neglecta* Ns = 14		*Sepietta oweniana* Ns = 25		*Sepiola intermedia* Ns = 15		*Sepiola robusta* Ns = 14	
	F	N	F	N	F	N	F	N	F	N	F	N	F	N	F	N	F	N
Crustacea	**97.56**	**80.99**	**91.67**	**62.26**	**96.30**	**77.78**	**71.43**	**55.00**	**100.00**	**80.77**	**71.43**	**62.50**	**92.00**	**59.46**	**80.00**	**75.00**	**92.86**	**88.89**
Amphipoda	48.78	16.53	12.50	5.65	33.33	14.29	14.29	10.00	11.11	3.85	14.29	12.50	20.00	8.11	46.67	35.00	35.71	22.22
Cumacea	–	–	–	–	–	–	7.14	5.00	–	–	–	–	–	–	–	–	–	–
Decapoda																		
Natantia	85.37	33.88	75.00	35.85	74.07	33.33	28.57	20.00	88.89	46.15	14.29	12.50	76.00	28.38	33.33	25.00	50.00	29.63
Brachyura	2.44	0.83	4.17	1.89	11.11	4.76	–	–	5.56	3.85	–	–	16.00	5.41	–	–	–	–
Unidentified	12.20	4.12	12.50	7.55	18.52	7.94	–	–	11.11	5.77	–	–	12.00	4.05	–	–	–	–
Isopoda	2.44	0.83	–	–	–	–	–	–	5.56	1.92	–	–	–	–	–	–	7.14	3.70
Euphausiacea	2.44	0.83	–	–	–	–	–	–			–	–	–	–	–	–	–	–
Mysidacea	65.85	23.14	20.83	11.32	37.04	15.87	–	–	55.56	19.23	35.71	31.25	36.00	13.51	6.67	5.00	64.29	33.33
Tanaidacea	–	–	–	–	3.70	1.59	–	–	–	–	–	–	–	–	–	–	–	–
Ostracoda	2.44	0.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Unidentified	–	–	–	–	–	–	28.57	20.00	–	–	7.14	6.25	–	–	13.33	10.00	–	–
Pisces	**36.59**	**12.40**	**70.83**	**32.08**	**29.63**	**14.28**	**35.70**	**25.00**	**38.89**	**13.46**	**21.43**	**18.75**	**48.00**	**16.22**	**6.67**	**5.00**	–	–
Others	**19.51**	**6.61**	**12.50**	**5.66**	**18.52**	**7.94**	**21.43**	**20.00**	**11.11**	**5.77**	**21.43**	**18.75**	**24.00**	**10.81**	**26.67**	**20.00**	**21.43**	**11.11**
Cnidaria																		
Anthozoa	–	–	–	–	–	–	7.14	5.00	–	–	–	–	8.00	2.70	–	–	–	–
Hydrozoa	2.44	0.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	7.14	3.70
Mollusca																		
Bivalvia	–	–	–	–	–	–	–	–	5.56	1.92	–	–	–	–	–	–	–	–
Cephalopoda	4.88	1.64	–	–	14.81	6.35	–	–	–	–	–	–	–	–	6.67	5.00	14.29	7.41
Gastropoda	–	–	–	–	–	–	–	–	5.56	1.92	–	–	–	–	–	–	–	–
Solenogastra	–	–	–	–	–	–	–	–	–	–	–	–	4.00	1.35	–	–	–	–
Nemertea	2.44	0.83	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Polychaeta	9.76	3.31	12.50	5.66	3.70	1.59	21.43	15.00	5.56	1.92	21.43	18.75	20.00	6.76	20.00	15.00	–	–

TABLE 2. Continued

Species / Prey category	Total Sepiidae Ns = 92		Total Sepiolidae Ns = 100		**All species** Ns = 192	
	F	N	F	N	F	N
Crustacea	**95.65**	**76.37**	**86.00**	**73.10**	**90.63**	**74.94**
Amphipoda	34.78	13.50	23.00	12.18	28.65	13.10
Cumacea	–	–	1.00	0.51	0.52	0.23
Decapoda	79.35	34.18	51.00	32.49	64.58	33.33
Natantia						
Brachyura	6.52	2.53	6.00	3.05	6.25	2.76
Unidentified	14.13	5.91	5.00	3.05	9.38	4.60
Isopoda	1.09	0.42	2.00	1.02	1.56	0.69
Euphausiacea	1.09	0.42	–	–	0.52	0.23
Mysidacea	45.65	18.57	33.00	17.26	39.06	17.93
Tanaidacea	1.09	0.42	–	–	0.52	0.23
Ostracoda	1.09	0.42	–	–	0.52	0.23
Unidentified	–	–	7.00	3.54	3.65	1.61
Pisces	**43.48**	**16.88**	**27.00**	**13.70**	**34.90**	**15.40**
Others	**16.30**	**6.75**	**22.00**	**13.20**	**18.75**	**9.66**
Cnidaria						
Anthozoa	–	–	3.00	1.52	1.56	0.69
Hydrozoa	1.09	0.42	1.00	0.51	1.04	0.46
Mollusca						
Bivalvia			1.00	0.51	0.52	0.23
Cephalopoda	6.52	2.53	4.00	2.03	5.21	2.30
Gastropoda	–	–	1.00	0.51	0.52	0.23
Solenogastra	–	–	1.00	0.51	0.52	0.23
Nemertea	1.09	0.42	–	–	0.52	0.23
Polychaeta	8.70	3.38	15.00	7.61	11.98	5.29

Ns = total number of stomachs examined; F = frequency of occurrence index; N = percentage of prey index

Distribution: A species known from several Aegean regions (e.g. Ostroumoff, 1896; Lefkaditou & Kaspiris, 2005).

An Atlanto-Mediterranean common species (Table 1) known from all the Mediterranean territorial areas and the Atlantic Ocean (e.g., Carus, 1889-1893; Ruby & Knudsen, 1972; Guerra, 1982a; Bello, 1990; Jereb & Ragonese, 1994).

Diet composition: The examination of the stomach contents of 25 (11 ♂♂, 14 ♀♀) individuals showed that the most abundant prey category was Crustacea followed by Pisces (Table 2). Among Crustacea, Decapoda Natantia was the most abundant prey category, followed by Mysidacea, Amphipoda, Decapoda Brachyura and Unidentified Decapoda (Table 2).

Sepiola affinis Naef, 1912

Material examined: 6 ♂♂, 3 ♀♀: stas. E, H and K; depth: 30-180 m; ML_{max} ♂ = 25 mm, ML_{max} ♀ = 30 mm.

Distribution: A rare species, known only from the North Aegean Sea (D'Onghia *et al.*, 1991, 1996; Lefkaditou & Kaspiris, 2005).

An endemic Mediterranean species (Table 1), known from the Western Mediterranean (e.g. Wirz, 1958; Mangold-Wirz, 1963) the Central Mediterranean (e.g. Berdar & Cavallaro, 1975), and the Adriatic Sea (e.g. Bello, 1990).

Diet composition: The stomach content analysis of the of 6 (5 ♂♂, 1 ♀) individuals showed that Crustacea, and particularly Decapoda Natantia (6 prey items) and Amphipoda (2 prey items) was the dominant prey category, followed by Pisces (3 prey items) and Polychaeta (3 prey items).

Sepiola intermedia Naef, 1912

Material examined: 16 ♂♂, 10 ♀♀: stas. 95, B and E; depth: 30-160 m; ML_{max} ♂ = 22 mm, ML_{max} ♀ = 21 mm.

Distribution: A species known from certain areas of the Aegean Sea (e.g. Paspaleff, 1943; Salman *et al.*, 1997).

An endemic species (Table 1), known from all the Mediterranean areas (except the Levantine Basin) (Torchio, 1968; Bello, 1990; Jereb & Ragonese, 1994). Guerra (1982a) reported this species from the Gulf of Cádiz (Atlantic Ocean).

Diet composition: The stomach contents of 15 (7 ♂♂, 8 ♀♀) individuals were examined (Table 2). The most abundant prey category was Crustacea. Among Crustacea, Amphipoda was the most abundant prey category followed by Decapoda Natantia, Unidentified Crustacea and Mysidacea.

Sepiola robusta Naef, 1912

Material examined: 7 ♂♂, 9 ♀♀: stas. 95, A, B, BK, E, I, L, M1 and W; depth: 0-280 m; ML_{max} ♂ = 21 mm, ML_{max} ♀ = 28 mm.

Distribution: Except from the present study, only Salman *et al.* (1997) and Salman & Önsoy (2004) recorded this species as a component of the Aegean cephalopod fauna.

An endemic Mediterranean species (Table 1) known from all the Mediterranean areas (e.g. Mangold-Wirz, 1963; Ruby & Knudsen, 1972; Bello, 1990; Jereb & Di Stefano, 1995).

Diet composition: The examination of the stomach contents of 14 individuals (6 ♂♂, 8 ♀♀) showed that the most abundant prey category was Crustacea. Among Crustacea, Mysidacea was the most abundant prey category, followed by Decapoda Natantia, Amphipoda and Isopoda (Table 2).

Remarks: Reid & Jereb (2005) noted that the record from Galicia (Spain, northeastern Atlantic) reported by Guerra (1984) is doubtful and it has not been confirmed yet.

The distribution of the Sepioidea species in the main geographical areas of the Mediterranean is presented in Fig. 2. The Mediterranean sepioid fauna composition regarding the main zoogeographical categories is given in Fig. 3. The percentages of the three zoogeographical categories in the Mediterranean territorial areas are shown in Fig. 4.

Prey categories found in the stomachs of the examined individuals, as well as the frequency of occurrence index (F) and the prey percentage index (N) values for each prey category are given in Table 2. In Fig. 5, the same indices are presented for the total of the examined sepiid and sepiolid species. Crustacea was the dominant prey category and based on the N index values, can be characterized as a preferential prey. Pisces was the second most dominant prey and it can be characterised as a secondary prey. Among Crustacea, Decapoda Natantia was the dominant prey category. Mysidacea were second, followed by Amphipoda and unidentified Decapoda. All the rest crustacean groups participated with very low percentages of frequency and abundance. Cnidaria (Anthozoa, Hydrozoa), Mollusca (Bivalvia, Cephalopoda, Gas-

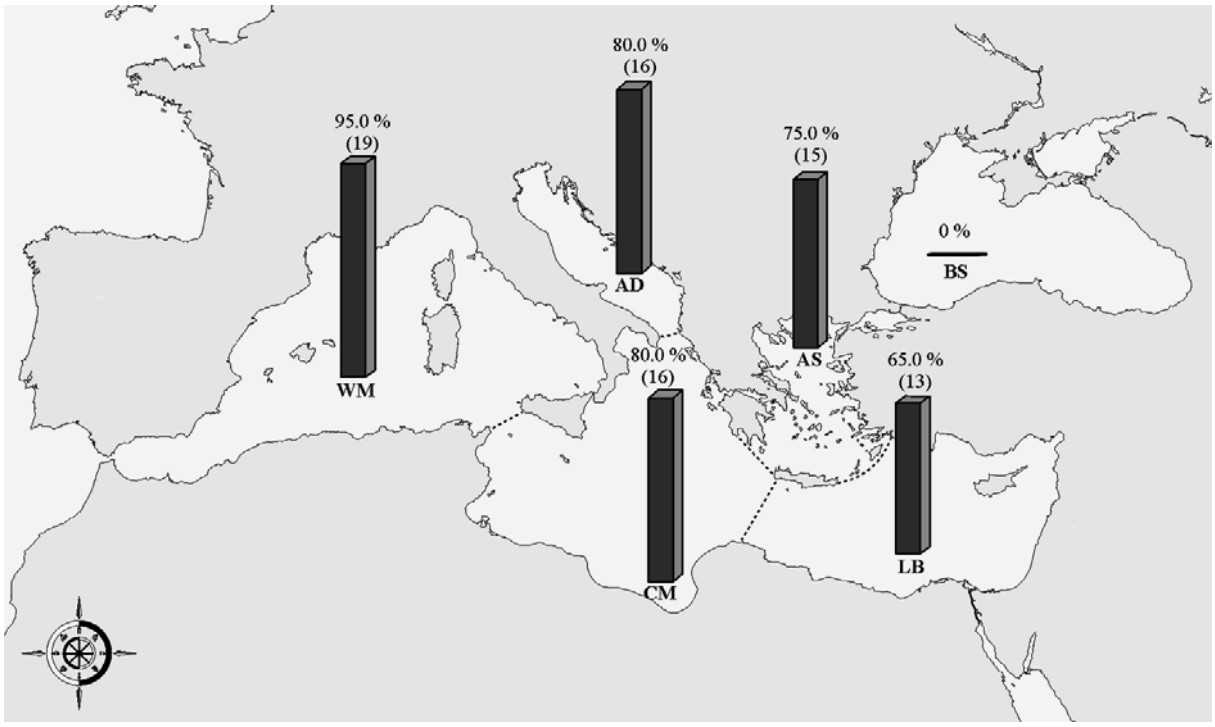

FIG. 2. Distribution of the known species of Sepioidea in the main geographical areas of the Mediterranean and the Black Seas, as absolute numbers and percentages of the total Mediterranean species number (abbreviations as in Table 1).

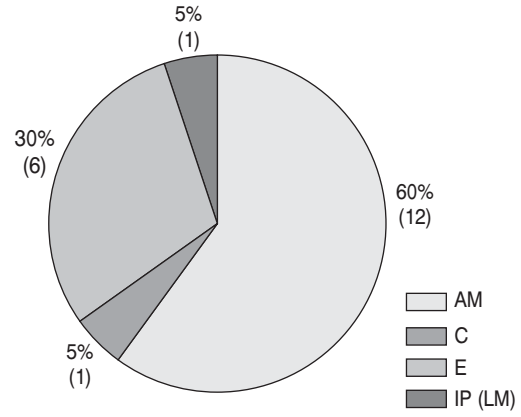

FIG. 3. Sepioidea fauna composition of the Mediterranean Sea (percentages and absolute numbers), regarding the zoogeographical characterization of the species (abbreviations as in Table 1).

tropoda and Solenogastra), Nemertea and Polychaeta were the least frequent and abundant prey categories in the diet composition of the sepiids and sepiolids.

DISCUSSION

Aegean Sea fauna

Except for the 13 species found in the present study, two more species of Sepioidea are known from the Aegean Sea (Table 1): *Sepiola ligulata* Naef, 1912 (e.g. Forbes, 1844; Lefkaditou & Kaspiris, 2005) and *Sepiola rondeleti* Leach, 1817 (e.g. D'Onghia *et al.*, 1991; Lefkaditou & Kaspiris, 2005). Thus, the Sepioidea fauna of the Aegean Sea numbers 15 species.

Based on the data of the present study, the known vertical distribution is extended for 8 species: 6 species extend their distribution in smaller depths, 1 species in greater depths and 1 species both in smaller and greater depths (Table 1).

Comparison of the Aegean fauna with those of the neighbouring seas

Torchio (1968) based on literature information, reported 3 Sepiidae and 15 Sepiolidae Mediterranean species. Bello (1986) and Mangold & Boletzky (1988) also reported 18 sepiid and sepiolid species from the Mediterranean Sea.

The review of the relevant literature showed that, up-to-day, 20 valid species of Sepiidae and Sepiolidae have been known from the Mediterranean Sea. Their distribution in the certain territorial areas of the Mediterranean and the Black Seas and the Atlantic and the Indo-Pacific Oceans, according to literature, is given in Table 1 and Fig. 2.

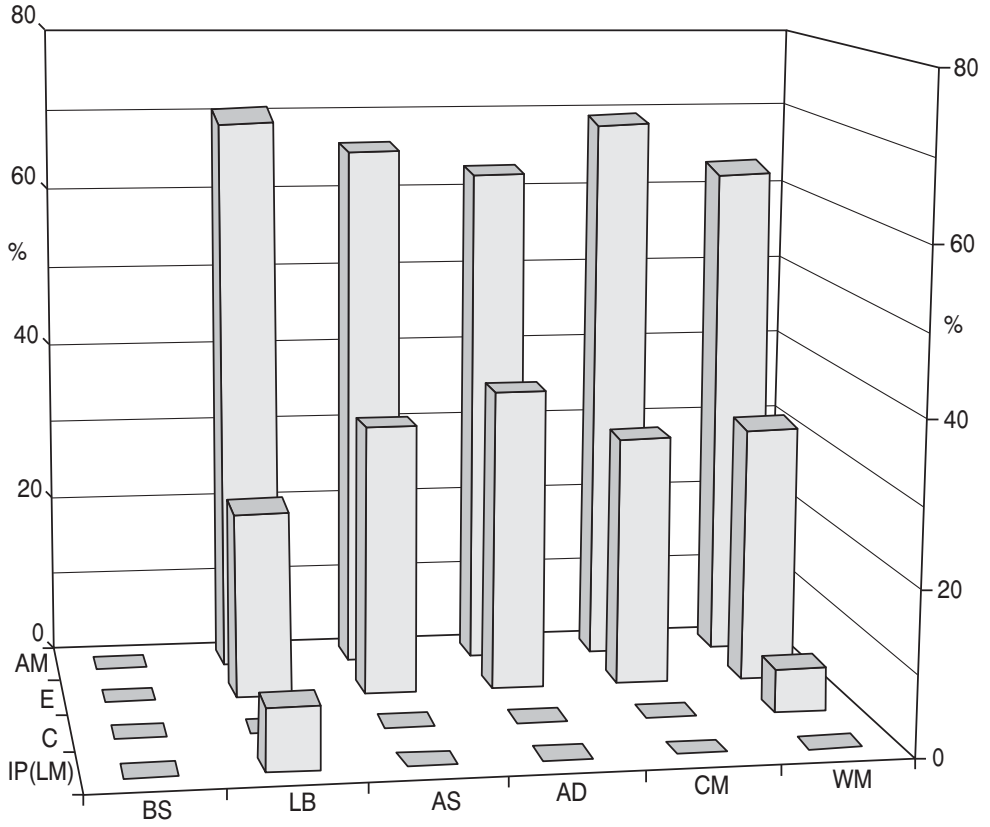

FIG. 4. Percentages of the four zoogeographical categories in the Mediterranean territories and the Black Sea; calculations have been made for the total of species known from each area (abbreviations as in Table 1).

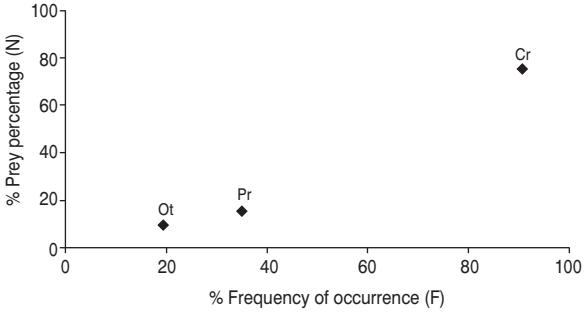

FIG. 5. Frequency of occurrence (F) and percentage of prey index (N) values for the major prey categories found in all examined sepioid individuals. Cr, Crustacea; Pi, Pisces; Ot, Others.

Western Mediterranean (WM): 19 species, representing 95% of the known Mediterranean fauna (e.g. Lumare, 1970; Orsi Rellini & Bertuletti, 1989; Orsi Rellini & Massi, 1991; Sartor & Belcari, 1995). The only species that has not been reported in the western Mediterranean Sea is *Sepia pharaonis* Ehrenberg, 1831. This should be attributed to its Indo-Pacific origin (Rocha *et al.*, 1998) and the fact that this species is considered as a Lessepsian migrant. The highest sepioid species richness in the western Mediterranean Sea should be attributed to the fact that the influx of Atlantic species is initially limited in this large basin, which has a wide range of physico-chemical parameters and permits the settlement of both cold and warm water species in its northern and southern parts, respectively (Koukouras *et al.*, 2001, 2007; Koukouras & Karachle, 2005).

Central Mediterranean (CM): 16 species, representing 80% of the known Mediterranean fauna (e.g. Adam, 1966; Bello, 1983-84; Jereb & Di Stefano, 1995). The relatively high number of sepioid species (16 species out of 19 found in the western Mediterranean Sea) in the central Mediterranean should be attributed to its direct neighbouring with the western Mediterranean Sea.

Adriatic Sea (AD): 16 species, representing 80% of the known Mediterranean fauna (e.g. Carus, 1889-1893; Torchio, 1968; Bello, 1983-84; Soro & Piccinet-

ti-Manfrin, 1989; Bello, 1990). Despite the unfavourable conditions prevailing in this area, namely: (a) its considerably restricted communication with the western basin (Ovchinnikov, 1966; Theocharis *et al.*, 1993), (b) the smaller amplitude of temperature variations (Delépine *et al.*, 1987), (c) the shallow waters of its northern part with relatively low winter temperatures and low salinity (Lacombe & Tchernia, 1960), it falls short by only two species in relation to the western Mediterranean Sea. This could be attributed to the intensive sampling effort carried out in this area.

Aegean Sea (AS): 15 species, representing 75% of the known Mediterranean fauna (e.g. Forbes, 1844; Athanassopoulos, 1917; Belloc, 1948; D'Onghia *et al.*, 1991; Katagan *et al.*, 1993; Lefkaditou & Kaspiris, 1998). The relatively high species number in the Aegean (15 species out of 19 found in the western Mediterranean Sea) should be attributed to the more diverse habitats and the intensive sampling effort that has been carried out in this area.

Levantine Basin (LB): 13 species, representing 65% of the known Mediterranean fauna (e.g. Rees, 1955; Gilat, 1964; Ruby & Knudsen, 1972; Knudsen, 1981; Salman *et al.*, 2002). The Levantine Basin has the lowest species number in comparison with the other Mediterranean areas. This should probably be attributed to the ongoing adverse conditions prevailing in this area combined with the instability of its environment in the recent geological scale which have led to an impoverished fauna (Por & Dimentman, 1989; Koukouras & Russo, 1991; Koukouras *et al.*, 2001; Arvanitidis *et al.*, 2002), as well as to the less intensive sampling effort carried out in the area.

Black Sea (BS): No cephalopods are known from the Black Sea. The absence of sepioid and cephalopod species in the Black Sea is a result of the peculiar oceanographic conditions prevailing in the area, particularly the low salinities and temperatures and the abiotic conditions in its deeper layers (Caspers, 1957; Mangold & Boletzky, 1988; Longhurst, 1998).

As it can be seen in Fig. 3, most species are Atlanto-Mediterranean, few are Mediterranean endemics, one species is a Lessepsian migrant and one species has a cosmopolitan distribution. According to Mangold & Boletzky (1988), the only known Mediterranean endemic cephalopod species belongs to the sepiolids which are benthic, while all the other cephalopods found in the Mediterranean Sea have been reported at least from the Eastern Atlantic. The relatively restricted geographical distribution of sepioids could be attributed to the fact that they are bottom-living species throughout their life cycle. Only *Stoloteuthis leucoptera* (Verrill, 1878) seems to have a cosmopolitan distribution, probably due to its pelagic mode of life throughout its life cycle (Orsi Relini & Massi, 1991).

Atlanto-Mediterranean species also dominate in each Mediterranean area separately (Fig. 4) and they are followed by the endemic species. Furthermore, the numbers of species of each zoogeographical category seem to decline from the west towards the east. The above considerations are also supported by the views of Mangold & Boletzky (1988), Koukouras *et al.* (2001) and Arvanitidis *et al.* (2002).

Sepiids and sepiolids diet composition

This paper provides for the first time aggregate information on the feeding habits of the Sepioidea fauna of the Aegean Sea since, until now, the relevant literature information is restricted to few species of this group.

The results of this study show that in all sepiid and sepiolid species, the most preferable prey category are crustaceans, followed by fish. These results agree with the limited relevant literature data. The available literature information is limited in certain sepiid species (e.g. Najai & Ktari, 1979; Guerra, 1985; Guerra *et al.*, 1988; Castro & Guerra, 1990; Blanc *et al.*, 1998; Reid *et al.*, 2005; Alves *et al.*, 2006) which mainly feed on crustaceans and pisces while molluscs and other preys, such as polychaetes, comprise a minor component of their diet. Some other papers deal with certain sepiolid species such as *Sepietta oweniana* (e.g. Bergström & Summers, 1983; Orsi Relini & Massi, 1988) which also feed on crustaceans (e.g. Decapoda Natantia, Euphasiacea), pisces, molluscs and polychaetes. Moreover, the diets of the studied groups consist of a wide variety of prey categories. This is in accordance with the general view that cephalopods are voracious predators feeding on a wide variety of live preys (Mangold, 1983).

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